GPU NUCLEAR

GPU Nuclear, Inc.
U.S. Route #9 South
Post Office Box 388
Forked River, NJ 08731-0388
Tel 609-971-4000

6730-97-2224

September 2, 1997

U. S. Nuclear Regulatory Commission
Attn.: Document Control Desk
Washington, DC 20555

Dear Sir:

Subject: Oyster Creek Nuclear Generating Station
Docket No. 50-219
Licensee Event Report 97-010: Manual Reactor Scram, Engineered Safety Feature Actuation and Design Deficiencies Noted As a Result of Main Generator Exciter Preventive Maintenance

Enclosed is Licensee Event Report 97-010. This event did not impact the health and safety of the public.

If any additional information or assistance is required, please contact Mr. Paul Czaya of my staff at 609-971-4139.

Very truly yours,

for Michael B. Roche
Vice President and Director
Oyster Creek

MBR/PFC
Enclosure

c: Oyster Creek NRC Project Manager
Administrator, Region I
Senior Resident Inspector

NRC FORM 366 (4-95)

LICENSEE EVENT REPORT (LER)

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Oyster Creek Unit 1	50 - 219	1 of 5

TITLE (4)
Manual Reactor Scram, ESF Actuation and Design Deficiencies Noted As a Result of Generator Exciter PM

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
										05000
08	01	97	97	010	00	09	02	97	FACILITY NAME	DOCKET NUMBER 05000

OPERATING MODE (9)	Run
POWER LEVEL (10)	100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR ': (Check one or more) (11)

20.2201(b)	20.2203(a)(2)(v)	50.73(a)(2)(i)	50.73(a)(2)(viii)
20.2203(a)(1)	20.2203(a)(3)(i)	X 50.73(a)(2)(ii)	50.73(a)(2)(x)
20.2203(a)(2)(i)	20.2203(a)(3)(ii)	50.73(a)(2)(iii)	73.71
20.2203(a)(2)(ii)	20.2203(a)(4)	X 50.73(a)(2)(iv)	OTHER
20.2203(a)(2)(iii)	50.36(c)(1)	50.73(a)(2)(v)	
20.2203(a)(2)(iv)	50.36(c)(2)	50.73(a)(2)(vii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Robert A. Henriksen, Senior Operations Engineer	(609) 971-4872

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE).	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

A manual scram was initiated in response to sparking in the main generator exciter commutator. The sparking was caused by a brush failure due to the use of incorrect parts. As a result of a low voltage condition, the emergency buses separated from off-site power and were subsequently energized by the emergency diesel generators. Several engineered safety features actuated. The two control rod drive pumps failed to start as designed. During a review of the transient, it was identified that the startup transformer voltage regulators were set to regulate voltage outside the plant's design basis as described in the degraded grid voltage study. A design defect in the control rod drive pump breaker control logic was also identified.

Corrective actions include repair of the exciter, resetting the transformer voltage regulators and adding a time delay to the control rod drive pump start sequence.

Date of Discovery

The conditions described herein were discovered on August 1, 1997.

Identification of Occurrence

A manual scram was initiated in response to sparking in the main generator exciter (EIIC EXC) commutator and was followed by a low voltage condition on the emergency buses (EIIC BU). As a result of the low voltage condition, the emergency buses separated from off-site power and the emergency diesel generators (EDG) (EIIC DG) started and re-energized the buses. The two control rod drive (CRD) (EIIS AA) pumps (EIIC P) failed to start as designed.

The reactor protection system (RPS) (EIIS JC) de-energized and resulted in the actuation of several engineered safety features – reactor isolation, primary containment isolation and secondary containment isolation. The reactor isolation and subsequent pressure increase in the reactor vessel (EIIC RPV) resulted in the automatic initiation of the isolation condensers (EIIS BL/EIIC COND) and the electromatic relief valves (EMRV) (EIIC RV).

During a review of the transient, it was identified that the startup transformer (EIIS EA/EIIC XFMR) voltage regulators (EIIC RG) were set to regulate voltage outside the plant's design basis as described in the degraded grid voltage study. The degraded grid study assumed that the startup transformer voltage regulators would be set at the neutral position; however, the regulators were set to reduce voltage.

These conditions are reportable in accordance with 10CFR 50.73(a)(2)(ii)(B) and (a)(2)(iv).

Conditions Prior To Discovery

The plant was operating at approximately 100% power. System pressures and temperatures were normal for full power operation. One of two 500 kilovolt (kV) power supplies to the regional grid was out of service. Preventive maintenance was being performed on the main generator exciter.

Description of Occurrence

While returning brushes into place during preventive maintenance (PM) on the generator exciter commutator, a brush shattered and caused extensive sparking. A generator field ground and insulation (EIIC ISL) fire in the ventilation exhaust ducting (EIIC DUCT) occurred. In response to this condition, licensed operators initiated a manual scram in accordance with plant procedures.

Description of Occurrence (Cont'd.)

The turbine (EIIC TRB) tripped automatically and power to the 4160-volt (V) buses transferred from the auxiliary (EIIS EA) transformers to the startup transformers. During the transfer, emergency bus voltages fell below the degraded grid voltage relay (EIIC RLY-27) setpoints and circuit breakers (EIIC BKR-52) feeding the emergency buses tripped after a time delay on sustained low voltage. Both EDGs started and picked up emergency bus loads. Loads sequenced properly except for the CRD pumps, which received start signals but immediately tripped on undervoltage. The reactor protection system de-energized during transfer to the EDGs and reactor, primary containment and secondary containment isolations occurred.

The main steam (EIIS SB) isolation valves (MSIV) (EIIC ISV) closed on the reactor isolation signal and the resulting pressure increase caused the isolation condensers to initiate and the EMRVs to open. The emergency buses were returned to off-site power and the EDGs were shutdown. The plant was placed in cold shutdown. With the exception of emergency bus separation from off-site power and failure of the CRD pumps to start, all systems operated as expected.

Apparent Cause of Occurrence

The cause of the generator exciter commutator brush failure was use of incorrect parts, which made them susceptible to dislocation. The manual plant trip was initiated to minimize further damage to the exciter and prevent damage to the generator.

The failure of the CRD pumps to start is attributed to a design deficiency. The circuit breaker anti-pump protection circuit prevents a CRD pump start if a circuit breaker is tripped with a close signal locked in. The CRD pumps received a start signal when the EDG breakers closed followed by a CRD pump breaker trip on low voltage. During restoration activities, both CRD pump circuit breakers were found open and discharged indicating that both circuit breakers tried to close and were subsequently locked out by the anti-pump circuit. Upon review of the event, it was determined that CRD pump breaker control logic design did not provide sufficient time for the CRD pump breaker undervoltage device to reset prior to an automatic CRD pump start.

The cause of the sustained low voltage on the emergency buses was that the startup transformer voltage regulators were set to control output voltage lower than the worst case voltage assumed in the degraded grid study. The study assumed that the voltage regulators would be in neutral, i.e. providing no regulation for the startup transformers. The voltage on the 4160V side of the transformer was assumed to vary only as a result of changes in the 34.5kV supply voltage. The operation of induction regulators and their effect on design basis assumptions for bus voltage were not clearly understood. Therefore, this

FACILITY NAME (1)	DOCKET (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REV	
Oyster Creek, Unit 1	50-219	97	010	00	4 of 5

TEXT *(If more space is required, use additional copies of NRC Form 366A)* (17)

Apparent Cause of Occurrence (Cont'd.)

assumption was not taken into consideration when the voltage regulators were set. Investigation subsequent to the event found that the voltage regulators for the startup transformers had been controlling voltage on the 4160V side of the transformers lower than that assumed by the degraded grid study.

When the plant trip occurred, regional grid voltage dropped approximately 4.5% due to heavy demand, the loss of station output and a 500kV substation out-of-service. However, this drop is within the design basis for grid response during a transient. During the transfer of in-house loads to the startup transformer, an additional 3-6% drop occurred across the transformers from no-load to full-load, which is expected. These voltage drops together with the regulator settings caused bus voltage after the transfer to be below setpoints of the degraded grid voltage relays and it did not recover above the reset point. After a nominal time delay, the degraded grid trip occurred and the emergency buses were separated from off-site power and powered from their respective EDGs.

Several of the regulators were found to have operational problems that had possibly compounded the low voltage problem by controlling even lower than set. However, even if all regulators had been operating as intended, the no-load output voltage of the startup transformers would have resulted in bus voltage too low to prevent separation.

Analysis of Occurrence and Safety Assessment

The degraded grid voltage protection system is designed to separate Oyster Creek emergency electrical buses from a degraded grid such that safety-related components supplied from those buses will not be adversely affected. Upon sustained low voltage conditions, power will be supplied by the EDGs. The degraded grid voltage protection system operated as designed and provided protection to the safety-related components powered from the emergency buses. The EDGs supplied power to their respective buses as designed and all loads except the CRD pumps sequenced onto the buses. All reactor protection system functions performed as designed.

Operator action to manually scram the reactor was conservative and appropriate in view of the existing problems with the main generator exciter. Operator actions to control plant parameters during cool down to cold shutdown with the reactor isolated were reviewed, and were determined to be appropriate. The separation of the emergency electrical buses from off-site power resulted in loss of power to the reactor protection system and closure of the MSIVs. This resulted in making a routine scram/turbine trip into an isolation scram event, which required use of the isolation condensers to remove decay heat. Loss of off-site power is an analyzed event.

Analysis of Occurrence and Safety Assessment(Cont'd.)

The failure of the CRD pumps to start did not affect the safety significance of this event. CRD makeup was not immediately required because all control rods were inserted, no significant change to reactor water level was occurring and the feedwater (EIIS SJ) and condensate (EIIS SF) systems were available to supply high pressure makeup. Long term use of the CRD system was not affected because operators were able to start the pump locally at the breaker after the undervoltage devices had been reset. If a total loss of offsite power had occurred, all high pressure makeup would have been temporarily unavailable until CRD flow was restored. This would not be significant since makeup was not required, power could have been restored to feedwater and condensate pumps from the combustion turbines via the station blackout transformer, and plant procedures provide adequate guidance to delay the plant cool down until makeup is available.

Plant operation at 100% power is considered to be the worst case for this event because of bus loading. Occurrences at lower power levels or higher grid voltage conditions may have prevented the separation of the emergency buses from the grid.

The loss of the preferred off-site power source caused an unnecessary challenge to safety systems and operator response.

Corrective Actions

- All exciter brushes were changed to the correct part and all incorrect parts were purged from inventory.
- The CRD pump control circuit was modified to correct the design deficiency.
- Startup transformer voltage regulators were repaired and returned to service.
- The voltage regulator setpoint was raised to ensure voltage levels on the startup transformers are maintained within the assumptions in the degraded grid voltage study.
- Operator tours of the startup transformer voltage regulators were revised to increase the frequency from weekly to daily and to include additional checks.
- The degraded grid voltage study will be reviewed to ensure plant operating conditions are consistent with assumptions in the study.

Similar Events

None.